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FIELD SEEDING OF TOMATOES

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INTRODUCTION

The tomato originated in the warm climates of Central and South America. Since domestication it has evolved into a plant that requires a long season to mature. Therefore, in a cooler climate such as that in Canada, the tomato plant can have problems in reaching full maturity. For this reason, the older tomato cultivars in Ontario have had to be transplanted in order to ripen fully. Fortunately, through centuries of domestication and intensive breeding, especially in the last few decades, tomato cultivars have been developed that mature in a relatively short growing season. Although a tomato cultivar has not yet become available that will mature early in the summer from field seeding (compared to establishment by transplanting), tomatoes can be direct-seeded for harvest in the latter part of the summer.

NEW PLANT TYPES

Current, early-maturing, machine-harvested, processing tomato cultivars are determinate, compact plants with a lower yield per plant compared to the more traditional cultivars. Consequently, they require higher populations in order to achieve economic yields. High populations of transplants are expensive and thus field seeding can be an economically viable alternative.

Figure 1. Clump-seeded H-2653 on clay loam soil 10 days before first bloom.

ADVANTAGES OF FIELD SEEDING

Besides the savings in time and labor, seeding offers a grower other advantages over transplanting for establishing a plant stand:

1. Lower cost per unit area (particularly at 25,000 to 62,500 plants/ha)
2. Less dependency on extra labor during the peak planting period
3. Better chance of obtaining disease-free seedlings
4. Greater flexibility in choice of cultivars and plant populations
5. Plant establishment (seeding operation) completed faster and earlier in the season, thus reducing the heavy spring workload
6. Better-quality fruit during latter part of the processing season

PROBLEMS ENCOUNTERED WITH FIELD SEEDING

Despite the advantages, many growers have been hesitant to adopt seeding as an alternative to transplanting, citing the following **disadvantages:**

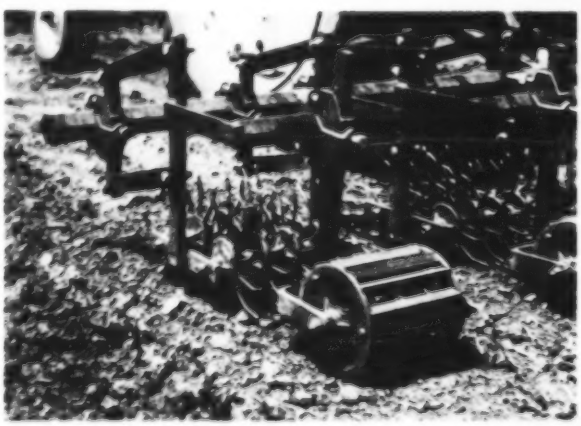

Figure 2. Combination of crust-breaking tines with special packer wheels, used effectively on top of seed row after a heavy rain. This is also an excellent cultivating tool when seedlings are small.

1. Poor or uneven emergence through surface-crusted soils
2. Weed competition
3. Necessity of blocking and/or thinning stands and proper timing of these procedures
4. Lack of earliness
5. Insect damage and sandblasting

Research, particularly in recent years, conducted in growers' fields and at experiment stations, has largely eliminated these objections.

ESTABLISHING TOMATOES BY DIRECT-SEEDING

Field seeding requires a total commitment by the grower; it will be successful only with good advanced planning and by following through with an integrated seeding system.

Four major factors for obtaining maximum yields from once-over harvest of direct-seeded tomatoes are:

1. Good soil (seedbed) preparation
2. Rapid, uniform seedling emergence
3. Plant population
4. Uniform, continuous seedling growth

SOIL SELECTION AND PREPARATION

Tomato seeds can be sown in a variety of different soil types. Select fields with uniform soil conditions. Tomato seeds respond to a proper environment; therefore, proper seedbed preparation is essential. Preferably follow a crop with low trash residues, such as a grain crop. On heavy soils, particularly where fall-plowed or fall-bedded, incorporate most of the phosphate and potash fertilizer as recommended from the soil test.

The following spring, shallow till 2-3 cm to make a smooth seedbed without disturbing the soil below, thus retaining soil moisture as close to the surface as possible.

Where fields are spring plowed, give the seedbed time to settle before seeding, preferably after a rain.

Injury caused by "sandblasting" of field-seeded tomatoes at the early growth stages has been experienced in some fields in Southwestern Ontario. If such damage is anticipated, one approach to counter such damage is rows of cereal crops on either side of the tomato row, later killed off with paraquat shortly before seedling emergence. A more traditional method of wind protection is to plant strips of rye (2-3 m wide) parallel to the tomato rows in 15-m intervals across the width of the field. Other promising alternative methods for sandblast protection are still under investigation.

NUTRITION

Applications of fertilizer should be made on the basis of a soil test. Such a soil test, together with previous crop experience, and the behaviour of certain cultivars on specific soil types, will be useful as a guide for the development of your own fertility program. Records should be kept to aid in future decisions, based on past yields in a given field. The optimum soil pH is within a range of 6.0 and 6.5.

A tomato plant established from field seeding is more efficient at taking up nutrients. Therefore, the amounts of nitrogen fertilizer (actual N) applied to a field-seeded crop should only be 25% of the rate of a transplanted crop of the same cultivar under identical field conditions.

Commonly this fertilizer is applied as a sidedressing between the 2- to 3- leaf stage until the first open cluster. Sidedressing after fruit-set delays maturity with most cultivars and will, therefore, reduce total marketable yields.

CULTIVAR SELECTION

At present there is no ideal cultivar available; i.e. one that germinates and emerges vigorously through difficult soil conditions under low temperatures in the early spring, and also has a host of agronomic characteristics such as earliness of maturity. Tomato breeders in Ontario, however, are addressing this problem. In consultation with your processor's field staff, select the earliest-maturing cultivars from those recommended in Ontario Ministry of Agriculture and Food Publication 363, *Vegetable Production Recommendations.*

TIME OF SEEDING

Sow seed from early May to May 25 for mid- to late-September harvest. Do **not** seed earlier than April 25 even in the most southerly portions of the province. During the first week of May soil conditions are generally favorable, i.e. the temperatures are warm enough for germination of the tomato seeds and soil moisture conditions are also close to ideal.

Sow seed into moist soil but as shallow as possible to achieve quick and uniform emergence. Soil moisture is often a limiting factor in seed emergence, especially in a season with insufficient rainfall.

ROW SPACING, PLANTING PATTERN AND SEEDING RATE

The common row spacing of 1.5 m or 1.65 m on a flat field or on beds used for transplants also suffices for field-seeded crops. (Figure 1).

For optimum single-row planting, aim to space plants uniformly within a population range of 25,000 to 62,500 plants per hectare.

With a seeder placing a continuous band of seeds, use 600 to 1100 g/ha (30 to 65 seeds per m of row). Thin seedlings at the 2nd to 4th true-leaf stage to a stand, with plants 22 to 30 cm apart. With a gel seeder or a plug-mix planter, drop a clump of four to seven seeds every 15 to 25 cm.

Twin-row planting is becoming popular as another tool to achieve higher economic yields, particularly with early-maturing, determinate cultivars. Twin rows spaced from 30 to 45 cm apart with seed clumps spaced 22 to 45 cm in the row (usually on beds with a row spacing of 1.65 m) has resulted in greater yields of ripe fruit.

TOMATO SEEDERS AND EQUIPMENT

Obviously, there is a wide range of acceptable seeding rates per hectare for optimal yields of tomatoes (65 g to 1100 g/ha); and as seed emergence can be extremely variable depending on soil conditions and other factors, any type of seeder now on the market which distributes seeds relatively evenly along the row is acceptable.

If seeds are sown in clumps approximately every 30 cm apart in the row, hoeing (if required) may be much simpler than if the seeds are distributed continuously along the row. Grower preference can be used in choosing a seeder. With clump seeding, good stands have consistently been obtained using Stanhay, Centra-flo, John Deere 33 and 71, Nibex, Webb and Dahlman seeders.

Properly-sized seed plates or belts must be matched with each seed lot if precision seeding is desired. Defuzzed (scarified) tomato seed, necessary for some types of precision planters, results in an even flow in seeder boxes and eases handling.

Most planter units, however, have been modified to suit each condition. Ideally, one utilizes a multi-purpose unit consisting of a bed shapen/sled combination to achieve slight reshaping of fall-beds together with possible fertilizer application and herbicide incorporation. Many growers mount their seeders onto the sled frame and thereby achieve several operations in one pass.

Tomato crop establishment by field seeding involves a relatively high risk to management. The use of pregerminated seed with a gel carrier or clump seeding with vermiculite topping to serve as an anticrustant, will reduce this risk to the grower considerably. However, it is not advisable to pretreat (vigorize) seeds, as it not only involves rather complicated procedures but also fails to give consistent beneficial effects under Ontario conditions.

Seedling emergence under difficult soil conditions, e.g. drier clay soil, has been shown to be more favorable using the plugmix planting system which dispenses about 75 ml (1/3 of a cup) of a mixture of moist peat moss, vermiculite and seed into the furrow. The micro-environment provided by the moist peat moss aids the seedlings' emergence. However, there is extra cost for materials and the preparation of the peat moss-vermiculite mixture.

Spring showers often result in severe crusting of the soil. Various types of crust-breaking machinery such as rotary hoes have been employed to assist young seedlings to counter this problem. A special tool, which combines crust-breaking tines followed by packer wheels (Figure 2), worked at moderate speeds on top of the seed row has been shown to be most useful.

MAINTENANCE OPERATIONS

Thinning

If thinning is required, thin plants when they are small, e.g., at the 2nd to 4th true-leaf stage. This not only minimizes plant competition but reduces damage from root pruning. At this stage of growth not only is it easier to facilitate thinning but there is less shock to remaining plants which recover more rapidly. Electronic thinners (originally sugar beet thinners) have been employed very successfully at this stage of growth.

There is no need to thin to single plants, as clump-thinning is sufficient. Small clumps (2-5 plants) develop and grow as single plants and give uniform concentration of fruit set. Singulated plants should be spaced at 15 to 25 cm while clumps can be spaced 22 to 30 cm apart. With twin rows use the latter spacing.

WEED CONTROL IN FIELD-SEEDED TOMATOES

(a) Chemical

One of the major limiting factors in establishing a tomato crop by field seeding is the lack of chemical weed-control methods. Enide (diphenamid) is the only registered herbicide available. Its strength is annual grass control but annual broadleaf weeds are not controlled. The best control with Enide is obtained under cool air and soil temperatures, but too cool conditions may also result in crop injury. Excessively warm conditions reduce the weed-control potential of Enide. Consult OMAF Publication 75, *Guide to Chemical Weed Control* for current chemical recommendations.

(b) Mechanical

Since the cost of hand-hoeing is prohibitive and counterproductive, only a fairly weed-free field should be used for field seeding tomatoes. Any perennial weeds should be controlled in another crop prior to tomatoes. If weed seedlings emerge before tomato seedlings come up, a non-residual herbicide such as Gramoxone (paraquat) may be necessary to prevent crop damage. This buys a little time, allowing tomato seedlings to emerge and get ahead of the weeds.

Cultivation can be very useful in keeping weeds under control. Discs or knives which cut very close to tomato seedlings leaving only about a 5-cm strip uncultivated early in the season are useful. This may be done several times to keep weed populations down to a manageable level.

The maintenance of a flat-top bed should be combined with each cultivation. Avoid unnecessary trips across the field as they will lead to soil compaction, added cost, and are contrary to good soil management practices.

Cultivation should control weeds and/or enhance growth. Poorly timed cultivation can prune roots and interfere with growth. Clod-breaking equipment such as rollers, tines and squirrel cages, used at an early stage, are very useful to break crusts.

In summary, the establishment of processing tomatoes by the field-seeding method is limited by poor chemical weed-control alternatives. Relatively weed-free fields, the stale seedbed technique using Gramoxone, the use of cultivation and hoeing, plus the possibility of some new registrations of promising herbicides are the extent of our weed-control arsenal at the present time.

INSECT CONTROL

Colorado potato beetle, flea beetle and cutworm damage can be very serious, particularly on field-seeded tomatoes. This is due mainly to bare fields at the time of seedling emergence, thus exposing the young tender plants to insect attack.

Apply insecticides (as recommended in OMAF Publication 363) soon after seedlings emerge, and repeat after one week to ensure proper coverage. Maintain a close watch until the young plants have reached the "transplant" stage (4-6 leaves). Subsequently, treat them the same as transplanted fields, by maintaining the recommended spray schedules.

GENERAL COMMENTS

If the system and general practices outlined above are followed, growers should successfully obtain tomato yields equal to or better than those from fields established with transplants.

Because of our relatively short growing season, it is doubtful that field seeding will completely replace transplanting of tomatoes in Ontario. But this practice already has replaced and likely will take over more fields used for later harvests, due to better-quality fruit produced in September and October from field-seeded plants.